TRANS

VOL. 62, NO. 47, PAGES 1153-1160

NOVEMBER 24, 1981

#### Seismology

TOTAL THE MONTH OF THE TOTAL OF THE STATES AND APPLICABLE OF STREET STATES AND APPLICABLE OF STREET STATES AND APPLICABLE OF THE STREET STREET, AND APPLICABLE OF THE STREET, AND APPLICABLE OF T

RIGHTHERMAL CRAPAS SHARED TO RETURNIES

ICTUTITY IN MOD FOLCARD PRELIMENTORS STRUGGEL

JAME, VYORUM

A. M., PITE U.S., Geological Survey, 415

R. All Stochtages

The Mad Volcane Indoordinated area to Tellogstons Sattonat Park to near the interesting of a

20-ba-long ages of northeast-freeding normal
fouls with the seator resurgent dose within the

500,000-year-old tetlomions malders. Recent
of the ceiders is at a saxiom 1788 ms since

19711 cear the Mod Volcane area. From 1971

through their 1972, less thes 10 acrobinates

11 argest X 2.11 were incested ethnic 1 km of the

Mod Volcane area. In May 1978, assumptables began
occurring becasts the hydrothermal area at depths
of 1 ro 5 ms. The select settlet continued

until the end of downstruith Entants aversa

1120 area by mr bour) occurring on Ontoher 21 and
covered? The intrest stone (M 1.11 occurred
on Govenber It and as least 8 erects were M 2.5

yr larger, he Desceler 1978, heat flur is the

Mod Tolorum hydrothermal features began hormasing stone of the Desceler 1978, heat flur is the

Mod Tolorum hydrothermal features began hormasing atong s 2-mailton hasheat breading sons.

Faisting and could from beckes more politic, near

mad acaldrons and funerales were yoursed, and
segetable to be inearly assistant was desclared and

the finates and funerales are fairly 1978 level

35 June 1330. Yhe spatial that the secane
cattesty stended presenting fracture sectors,

passatisting increased fluid five from Goothe of the 

George Communication Communication (Communication Communication Communic

6930 Structure of the fruet end l'aper Montie CRUSTAL STRUTTURE SEAR THE ARCTIC MIS-OCEAN

organization of the fract and ipper Mantle CRUSTAL STRUTTURE SAME TRE JECTIC MIS-OCEAN SEEDS 8. 6. Je-ha-in jariantic in-action in Centra, Darimouth, M. 6. S. T. C. (Stade, 27 Ani) i. Bell and 6. K. M. Selcomer Select relieving out at the FRAM i i.m. states attack relieving out at the FRAM i i.m. states attack relieving out at the FRAM i i.m. states attack relieving out the translation rear the Assite Mid-organ Sides attack. This ridge is tyteraling at the resty sides to observed at the resty and the parameter attack relieved to the resty sides at observed at distarce target sizes of typically i.is of which 6. Frame be stribured to typically i.is of which 6. Frame be stribured to typically i.is of which 6. Frame be stribured to typically i.is of which 6. Frame be stribured to typically instruction stributed and stribured the relieved for the 8 self-section inner studies, but crusted with these studies, but crusted without the self-section in the stribure of the self-section in the section in the section of the section of

J. Gaophys. Bess. Rud, Papes 181644

6970 Strutture of the crust and opper mustle
698 LChd-FERN THICKENING OF THE OCEANIC CRUST
J. 5. Reclain ideology Department, Onlearaily
of California, Savia, California 91616)
A camber of studies of saisasts refrection
date have resulted to Suggestion that the
ceesale Crust hilthess with age, perhaps over a
long lies spac. It it difficult is recordile
motions of student intecture and formation. In
this stedy as have to-grained date couplind
fices a number of sources to obtain trustes
thickness and age permenters for 100 different
refravition profiles to the Sacific. In strampt
was saft to sected date which eight hass
poorly detacteded values at crustel thickness.
The crust does appear to thickness, the crusted which along the probable bisses are reseved from the derecrustel shirhening is not significant to a 955
continous issuit if ten e-y, emeples are used,
deverse, if rue takers sample intervales at Cono, and 30-100 c.), there appears to be seen
different to the servage areasal rhickness,
from in the letter same, the second
form of the condition of mass to the creat
receive fremous.
Geophys. Res. Lett., Super LLLSLE

Geophys, Res. Lert., Separ ILLIST

6978 SERVETURE OF THE CRUET END UPPER MEMPIE THE 1978 SELLOWSTOUR-PASTERN SHAKE STREET SEALTH SELSNIC SPOTELING EXPERIMENT: CRUSTAL SPRICTURE OF THE YELLOWSTONE REGION AND EXPORTMENT DESIGN

a.e. faith (Superisons of Geology and Geophysics University of Utah, Sair Laha Ciry, Grah &Allis) University of Utah, Sair Laha Ciry, Grah &Allis, Sh. Mastise, and R. V. Glassmic Iday

Is 1538 a sajor selemic profiling separtment was conducted in the Lalicerone-menter Snahe

Rivo, Plain saglow of Idahs and Myoning. Piffess shate were recorded that provided coverage to distance of 100 km. In this paper, trevet-lise and synthatic sair senguam endoling as used of the sense of 100 km. In this paper, trevet-lise and appeared Quarter of the area included to walking a structure of the area included the sail-known hydrochemes! Yearther set Intuition the sail-known hydrochemes! Yearther set Intuition to Quarter or year-features ettributed to shallow drustal sources of unage. The evenage of the structure of Quarters are set of (1) A highly variable, asser-surface ingress of (1) A highly variable, asser-surface interpretate of (1) A highly variable, with a compensation of the scanned of the compensation of the state of the sail o

valocity of 6.7 km/s to 6.8 km/s and an apparent q of 1001 and (6) A total saustol iBlchass of 41 km. The uppes-cruest layer, 3.5 km/s is 6.0 km/s, is rhought to be the thermilty-sites at equivalent of the continents regularization according to the continents of the same ther is permatly 13 km to 20 km thick in the surrounding thermality undisturbed Arthum state, as interpretation from the mannishays passets that mette moits from the mannishays passets that mette moits from the mannishays passets that mette moits from the mannishays assisted the lower store richard significant assistions is the volosing structure, but produce the mais source of host rhat drives the voleral and hydrothermal systems of Tellowatons. The high apparent arrounction and large listent aniotity vocistions in the upper-trust are completes with a model in whith passis irrationalized the original upper-taset to produre siliferanting the original upper-taset to produre siliferanting that that were mercuded as shyutices and ash they turn to be super-tased to enter a foreign and solve the first terms of the manistract with the videous in state that were marruded as shyutices and ash they state and the enters in the propagation of silistic volcanic enters along the enters faste liver of sis to their present location hearth the yellowepone hydrothermat system. While they allowepone hydrothermat system. While they allowed they are also the continuous particles and source of the hast, i.e. mannia plumes.

Ithoughter is saturated and the first hydrothermated and they have a supposite eed compastional bounderses. J. Gasphys. Ens., Red, Seper LBISSE

6970 Structure of the crust and upper stalls
THE 1978 YELEOWSTONE-FASTERN SMAKE RIVER PLAN

6970 Structure of the crust and upper manila
THE 1978 YELCOSTONE-LASTERN SHAKE RIVER DIAIN
SEISMIC PROFILING EXPERIMENT: GATA AND UPPERCRUSTAL STRUCTURE OF THE TELLOWSTONE REGION
N. M. Schlify (Department of Geology and
Geophysica, University of Utah, Sait Labe City.
Utah 84112), R. B. Smith, L. M. Brails, and
J. Ansorga
Eleven is-line refraction profiles, recorded to
distances of 100 km, and one azimuthal fan plot
have come tructed from data recorded with a 190tiation array in the Yellowstone National Park
area during the 1978 Yellowstone-Snake River
Plain selsmic experiment. Interpretations of.
the data suggest that the crustal P-wave valacity
model for the Tellowstone region is characterized by: (1) an averaged 10 km-thick uppercrustal layer, V. 8.0 km/s; (2) an everage
trustal velocity of 6.3 km/s; and (3) a tolet
trustal thickness of 44 km. Yelocity stockies are
presented for profiles that emphasize the uppercrustal velocity of 6.3 km/s; and (3) a tolet
that top of the opper-crustal crystalline bissemin
from 5 km in movthwesters Yeliconton near, 131nd
Park to 1 km at the sortheast cide of the fallowstone Platesu, that is interpreted as a propersisive thinning of the silicic surface widenic
layer to the northeast; and (2) evidence, for a
large lateral linkonogenelty interpreted to be
low-velocity body, with a decrease of alless to be
a large lateral linkonogenelty interpreted to be
northeast corner of the Yellowstone platesu. The
low-velocity some coincides with a local-30 mpl
realdwat gravity amonally and is located beneath
the Hot Springs Besin, the largest hydrothermal
the Mot Springs Besin, the largest hydrothermal
the Mot Springs Besin, the largest hydrothermal
the Mot Springs Besin, the largest hydrothermal
the Hot Springs Besin, the largest hydrothermal
the Hot Springs Besin, the largest hydrothermal
to have been considered and many ferpresent i

J. Gaophys. Rus. , lol, Paper 181697

News

#### SMM Detects New Reactions in Solar Flares

Agemma rey and nautron epectrometer instrument built el the University of Naw Hempshire undar direction of Edward L. Chupp hes detected several important new kinds of emissions from soler flarae. The instrument was founched Feb. 14, 1980 on the Soler Maximum Mission setellita. Chupp reports that during a major flare on June 21, 1980, his experiment made the first clear observations of naufrom reeching the earth from a soler tiere.

Neutrone ere neutral subetomic perticles created in nudear reactions with flerss. Free neutrone decay sponlenegusty into protons and electrons in about 15 minutes, so only very high apeed neutrons cen reach the earth at ell. es ight takes about 8 minutes to reach the earth from the sun. In the June 21 flere an intanse burst of gemma raye, lasting about 1 minute, wes followed by a 20-min streem of naulions. This particular flare was probably the most intense to occur during this soler cycle.

in another flara on April 27, 1981, Chupp's instrument observed gamma reys with energiee characteristic of several varielles of nucleer reactions theorized but naver bafore seen on the sun. These reactions are caused when protone moving at neerly the epeed of light coilids with other atoms in the eoler etmosphere, including nitrogen, silicon, magnesium, Iron, lithlum, and baryllium atoms. This provides veluable cluee about the abundances of different etoms in soler fares and the macheniem in which protons are accelerated m high epseds. A Jepenesa soler research estellile also observed this same flare and confirmed many features of the observations.—PMB [Source; NASA] &

#### Qeophysical Events

This is a summery of SEAN Bulletin, 6(10), October 31, 1981, e ublication of the Smithsonian Institution. The complete buildin is available in the microfiche edition of Eos, es e microfiche supple ment, or es a paper reptint. For the microliche, order document number E81-010 et \$1.00 from AGU, 2000 Floride Avenue, N.W., Weshington, D.C. 20009. For reprints, order SEAN Bulletin (give dates and volume number) through AGU Separetes: \$3.50 for the first copy for those who do not heve a deposit account; \$2 for those who do; additional copies era \$1,00. Order must be prepaid.

Mt St. Helens (Washington): Lava extrusion adds new libe to composita dome (saa spacial raport in Eos, Nov.

Kıskelau (Indonesia): Small ash clouda (antira report

Langlia (Naw Britain); New leva ilow, incandescent leph-(a. ssh amission

Menam (Bismarck Saa): Incandascent tephra, glow, ash



#### TRANSACTIONS, AMERICAN GEOPHYSICAL UNION

The Weekly Newspeper of Geophysics

Send double-spaced manuscripte (tour copies) to Eos, AGU. 2000 Florida Avenue, N.W., Washington, D.C. 20009, or send then directly to one of the eesoclete editors with a copy to the

Editors A. F. Spilheue, Jr.: Associate Editors: Cleude J Allegre, Peter M. Bell, Kevin C. Burke, Amold L. Gordon, Kristina Kalsaros, Gererd Lachapelle, Christopher T. Russell, Richard A. Smith, Seen C. Solomon, Cerl Kisslinger; News Writer: Berbare Richman; Editor's Assistanti Sendra R. Merks; Eos Production Staff: Petricia Bangert, Mergaret W. Conelley, Eric Ger-ison, Jamee Hebblethwalte, Dae Sung Kim, Michael Schwartz.

Officers of the Union

ident; Jemes A. Van Allen, Pe Leslie H. Meredith, General Secretary; Cerl Kleelinger, Foreign Seclelary, A. F. Spilhaue, Jr., Executive Director, Welde E. Smith, Executive Director, Welle Director, Welle Director, Welle Director, Welle live Director Emeritus.

Vertising that meets AGU standarde is accepted. Contact Robin E. Utile, edvertising coordinator, 202-462-8903.

Es, Trensections, American Geophysical Union (ISSN 0098-3941) a published weekly by the American Geophysical Union from 2000 Phirida Avenue, N.W., Washington, D. C. 20009. Subscription available on the control of the c the on equest. This leave \$5.00, Second-oless postage paid at Washington, D. C., and et additional mailing offices.

Copyright 1961 by the American Geophysical Union. Material pubished in the issue may be photocopied by individual edentiats for research or classroom use. Permission te eleo granted to use short Wicks and figures and tablee for publication in acientific books and burnels. For permiseion for any other uses, contact AGU Publishing Italians Office, 2000 Florida Avenue, N.W., Washington, D. C.

flews expressed in this publication are those of the authors only and to not reflect official positione of the American Geophysical Union Wess expressly stated.

Cover. A joint meeting of the American Geophysical Union's Oceanography Section and the American Society of Limnology and Oceanography will be held February 16–19, 1982; In San Antonio, Tayan balo, Taxas. See page 1,167 for detaile.

Ruepahu (Naw Zeelend): Increesed seismicity; lower creter leke lemperelures; eruption expected (excerpt of report

Sakurazime (Jepan): Frequent explosions, Iwo Incandescani columna Submarine volcenos (North Pecilic Ocean): Observatione

et three sitee summerized. Suwenoeezime (Ryukyu lelende): Jenuery-August 1981 explosione tabuleted.

Etne (Sicily): Small plumes on satellite images. Soulriare de le Guadeloupe (West Indiee): Temperature, magnetic field steble.

Almospheric effecte: Aircreft end setellite dele on stralospheric ejecta from four eruptione.

#### Seismic Evente

Eerthquake Swarm

Mehetia Volcano (French Polynesie): Severel months ol increased eeismicity (entire report printed).

Krakatau Voicano, Sunda Stratt, Indonasia (6.10°S, 105.42°E). All times are local (GMT + 7 h). Explosions from Anek Krekateu resumed October 20 alter saveral months of fumerolic ectivity. Guy Camus and Pierre Vincent vielted the voiceno for 4 hours during the elternoon of October 19 but noticed no premonitory activity. Explosions began between 0300 end 0400 the next morning. From Rokele leland (ebout 3 km SE of Anak Krekatau), Camiis and Vincent noted 19 explosions in the 2 hours just after sunriea, before leaving the island. They had saen several others by midallernoon during discontinuous observations from a boat. Most were initiated by a 'cannon-like' explosion from the main cone, followed by convective expansion of the eruplion column (typically to 400-600 m, but occasionelly to 1 km in height). No noise could be heard on Rekate Island. The explosions usually lasted from one to several minutes, but the last one observed by Camus end Vincent es they left the eree began at 1511 and continued until 1525. Most of the eruption columns were dark, conteining abundent esh but few blocks and no incandescent material. Water vepor could be seen condensing at the top ol several aruption columns, and lightning was occesionally observed. Ash fall on Sartung Island, about 2 km W of Anak Krakatau.

Informellon contacts: Guy Camus and Plerre M. Vincent, Départament de Géologia et Minérelogie, 5. Rue Kesster. 63000 Clarmont-Farrend, Franca.

Ruspehu Volceno, North Island, Naw Zealand (39.28'S. 175.57°E). A swarm of discrete shallow earthquakes bagan gradually Septembar 7 and continued until October 2. terminating with a slightly deepar (2-km dapth) event. Harmonic tramor has increased standily since then and was quita strong and elmoet continuous after October 14. Crater laka lemperatures decreased from 32.5°C in late April to 11°C in early October. Pariods of low crater lake temparatura preceded strong eruptions in June 1969 and April

Information contact: J. H. Laltar, D. S. I. R. Geophysics Division, P.O. Box 8005, Wellington, New Zealand.

#### Ferthaueka Swerm

Mehetle Volcano, Society Islands, French Polynesie, South Pecific Ocean (17.88°S, 148.07°W). All times are GMT. The lollowing is from a report by J. Talendier:

A swarm oi earthquakes centered beneath Mehetie began euddenly on March 6 and continued into lele October. After the first 2 days of the swarm, cheractarized by numerous weak evenis, seismographa began to record occesional larger ehocks. The eelsmic energy ralessed during tha ifret week of the swarm greatly exceaded the previous total energy release detected by the Tahiflen seismic nel eince the first stations were installed in 1962-63. Both the number of earthquakes and energy release varied considerably with periode of increased activity esperated by brief lulis. Epicentare were about 10 km SE of the crater. There were eavaral groups of loci, which may indicate verticel migration, but il was impossible to compute depths of locus for most of the evente. A temporary seismic station operated on Mehalia Merch 25-30 recorded local earthquekas at about 13-km depth.

By lete October, more than 3000 local events of magni tude 0.9 M<sub>L</sub> or etronger had baan recorded. Of lhase, about 30 were stronger then 3.0  $M_L$ , including magnitude 4.0 and 4.3 ehocks. Beceusa of the detaction fimits (usually about 1.1 M<sub>L</sub>, but waakar seismicity le sometimas recorded during periode of lessar microselemic noise) for events in the Mehella area (about 140 km from the naarest Tahlilen net station), harmonio tremor, il eny, probably would not ba recorded. Talendier's extrapolation of the well-defined frequancy-magnitude relationship indicates that about 50,000 evenie greater than 0.1 M<sub>L</sub>, have probably occurred during the swerm. Talendlar also notes that the Mehelle swarm end seismicity associated with Hawalian voicance showed similarities in number and magnitude of evante and safemogrem characteristice, as well as the datection of long-period waves that could be generated by events occurring benaeth a magme chamber. No auriace voicenic activity has bean reported at Mehetia. The Island is uninhabited, working conditions there are difficult, and no geologist has viell-

ed the area recently. Mehetia is a well-defined cone about 1500 m in diameter and 435 m high, with a 200-m-diamater crater at the eummit. No historic eruptions have been raported, but the limit-'ed arosion of the cratar end flanks, leck of vegetellon at the summit, and Tahitlan legands of 'big fires' all indicate thet

eruptions probably took place less then 2000 yeers ago. Information contact: J. Telandier, Laboratoire de Géophyelque. Commissariel a l'Energie Alomiqua, B. P. 640, Papaale, Tehiti, Polynéale Fronçeise.

Dele	Time, GMT	Magni- lude	Letitude	Longitude	Depth of Focus	Region
Oct 16	0326	7.1 M <sub>e</sub>	33.00 S	72.89° W	62 km	oli centrat Chilean coasi
Oct 18	0431	5.5 M,	8.10°N	72.47` W	ehettow	N Colom- bia
Oct 25	0322	7.1 <i>M</i> <sub>s</sub>	18.32°N	101.96° W	64 km	off the coast of S

The October 16 earthquake, centered in the Pacific Oceen about 150 km W of Valpereiso, was fall throughout central Chile. One person died and three were injured in en auto crash when two drivers panicked; little damaga was reported. Twelve persons died and t00 were injured in the city of Cucula, Columbia, on October 18. The shock domnged buildings in Cucula and orifacont San Cristotini, Vonezueta, and was widely lott in the Colombin-Vanezueta bordor region. On Novembor 26, 1980, an ovent contered about 30 kin to lhe E injured 36 people and badly dnmaged 30 buildings in Cucula. On October 25, one person was killed by a felling power transformer in Mexico City, where Intensities reached 6-7 Mercalli. Intensitias did not exceed about 6 Mercaill in the epicentral area (roughly 400 km SW of Mexico City), where damage was rolatively light. Lomnitz notes that many events centered along the coast of Moxico have a high  $M_n$  but low  $m_b$ , causing damage to be concontrated some distance from the epicentral area.

Information contacts: National Earthquake Information Service, U.S. Geological Survey, Stop 967, Denvor Foderal Center, Box 25046, Denver, Colorado 80225 USA, Cinna Lomitz. IIMAS-UNAM, Apartedo 20-726, Mexico 20 DF. Mexico; Notimex, Maxico City, broadcast; Agencia EFE, S.A: United Press International.

#### Meteoritic Events

Possible melecrite tall. Alps Region, 1977 Firaballs: Atlantic Ocean, Germany, Italy (2). Netherlands, east central USA, California. A

#### Deep Space Antennas

Three 26-m trecking antennas operated by the NASA Deep Speca Nelwork at Goldstone, Calil.; Madrid, Spain; and naar Canberra, Australia, will cease operations on Dec. 1, 1981. The stations will continue to operate 64-m and 34·m deep space tracking antannas. Ending operation of the 26-m entennes will cause a reduction of about 30% of the Deep Space Network tracking and data acquisition capability. This means less support for NASA planetary spacecratt. Currently, the Deep Space Network is supporting Voyegers 1 and 2, Helios 1, the Mars Viking 1 Lander and Pionears 8 through 12.

It is estimated that terminating operation of the three antennas will reault in savings of about \$7.2 million per year, beginning in liecat year 1983.—PMB [Source: NASA] 5.

### **USGS Solicits Research Proposals**

The U.S. Geological Survey Invitas proposels for reseerch contracts under the continuing Earthquake Hazerd Reduction Program. The proposed research must be directed toward the idantification, evetuetion, and charecterizaflon of immediate and long-lerm seiemic hazards. Program objectives end tesks required to achieva these objectives are described in Proposal Information Package RFP-

Written Inquiries concerning this program end requaets for the proposel information package should be addressed to Contracting Officer, U.S. Geological Survey, Mail Stop 85, 345 Middletield Road, Menio Park, CA 94025, Proposals must be received by Februery 19, 1982. The USGS axpecis lunding of selected programs to alart on or attar Ocfober 1. 5

#### **Geophysicists**

Richard Henry Jahns, professor of geology and dean of the School of Earth Sciancee of Stanford University, was ewarded the American Geological Institute Medal in mamory of lan Campball. Jahns is the first to receive the award. established in 1980 by AGI. Jahns ta an AGU Fellow.

M. King Hubbert received The Franklin Institute's Ellioff Cresson Madel recently. From 1964 until his retirement in 1978, Hubbert, an AGU Life Membar, was a research geophysiciet with the U.S. Geological Survey.

David H. Miller at the Milweukee campus of the University of Wieconein, recantly began a 1-yaer appointment undar the National Oceanic and Atmospheric Administration's senior academician program at the National Climate Program Office. His duties wilt include en assessment of climela applications and the development of plane and programe to improve the affectiveness of the National Climata: Program. 9

## The Oceanography Report



SHAINE DEPOSIT

#### The Oceanography Raport

The local point for physical, chemical, geological, and biological

Associate Editori Ainold L. Goldon, Lamont-Dolloity Goolog-tcal Obsolvatory, Palisades, New York, 10964 (telephone 91-1 359-

### Graduate Enrollment in Oceanography

Charles D. Hollister and John G. Scialer

Excellent job opportunities exist for well-trained Ph.D. greduates in marine geology, geophysics, chomistry, dynamical-physical oceanography, and oceanographic engi-

This was one conclusion the deans of verious schools of oceanogrephy roached at a conference that included deens from Oelhousie University, Florida State University, the University of Howall, the University of Mornt, Oregon State University, the University of Rhodo Island, Scripps Institution of Oceanography, Texas A & M University, the Universlly of Washington, and the Massachusetts Inatitute of Technology/Woods Hole Oceanographic Institution Joint Program in Oceanography. The results of this effort, combined with some of our own notions, form the basts of this short report. We hope that these thoughts will serve as a discussion base for more in-depth reflections.

The Information supplied by each institution revealed that In the years just prior to the meeting in 1980 there had been too few qualified applicents in the lields of physical oceanography, geologic-geophysical oceanography, and ocean engineering to lill evailable vacancles. Each institution reported that over 50% of its total epplicants were in biological oceanography. The supply of chemical oceanography applicants appeared matchad to demand. Mathemetics was generally found to be the principal weakness in many of the applications regerdless of discipline.

On the demand side, there were found to be too lew Ph.D.'s for the job market in all fields of oceanography except biological oceanography, although most well-trained (cross discipline) biologists had little trouble in Ihis regard. Other alatistics that emerged included (1) ecceptance rate for offers of admissions averaged 50%. (2) average time to Ph.D. from B.S. degrees wes about 6 years, and (3) drop out ratea generalty averaged about 25%

Graduales who heve the atrongest background in the basic sciences were considered more attractive by recruiters, end those students who investigate a problem as it traverses disciplines seem to do better in the job market than those that conline their inferests to the bounds a single dis-

The Ilme, effort, and expense of recruiting certainly seem worthwhile, for institutions that did creative recruiting acquired a higher percentage of the candidates they had sought. Recent preapplication recruiting has aubstantially increased the number of good epplicants to a givon school. Success was also reported whan active research scientists recruited in schools not elready affittated with oceenogrephic programs and in depertments such as physics, math. chemistry, and engineering

One recent proposel lo AGU to do broad-scala, netionwide recruiting and tocturing about career opportunities in oceanography, in o nonschool specific lashion, has been declined. Thus II appoers that each achool will have to mount its own effort. Paid advertisaments in school newspapors end journals widely read by undorgraduales may be one way of initiating such on effort.

The prevailing Washington, D.C., mood, as relfacted in lite recent skirmish ovor NSF Graduate Fellowships, suggests that support for those fellowships will probably come under renewed allack next spring. It was concluded that gradualo student support will be increasingly hard to find

If present economic trende in this administration continue, we will lieve to rely even more heavily on the supply side of the economy to support tha training process of our new scientista. Cross-sectoral tinkeges between inclustry and academic must be lorged es soon aa possibla if induairy expects to continue to reap the harvest of walf-trained oceanographers that it hea enjoyed up to now.

Charles D. Hollister is the Dean of Graduale Studies, Woods Hole Oceanographic Inetitution, Woods Hole, Mass. John G. Scialer is the Director of the Joint Program, Massachusalts Institute of Technology, Cambridge, Mass.

#### Opinion

#### Scientific Freedom and the Sea

As one of the smell band of professional marine scientista who heve ectually been delegates to the UN Lew of the See Contersnce and who have been actively involved in negotieting soma of the texts, I was most interested to read Devid Ross' srtide on marine scientilic research. (Eos. 62, Sept. 1, p. 652). I was particularly glad to see that he urged e constructive attitude toward what many scientists seem to feel is e totelly unjustified ettempt to curb their

Two aspects of the negotistions were particularly importent in this regard. First, it was found impossible to differentlate satisfectorily between acedemic, economic, or millery reaeerch. Much marine research (lor instance that concerning gravity or water column temperature) is equally valueble to all three. Much apparently 'scientific' reaearch is cerried out by academic personnel using commercial subcontractors end supported by military funds. Typical of the confusion were lerge gravity, magnetic, and bathymetric surveys carried out by the U.S. Navy and NATO over the continental shelves of meny Atlantic and Mediterraneen coestal atetes (without notification or consent) during the 1960's, preaumably under the justification that they were primarily military in purpose and therefore not covered under the exieting 1958 agreement

The resentment and mistrust that was crested emong the smeller coastal states by this end similar kinds of ection was the dominant atmosphere under which the early framework of the marine scientific regulations was laid down. Representing one of the smaller coastel atalss myself, I became aware of many other examples of ebuse that had occurred in the name of scientific freedom by universities and agencies who believed that they were working for the greater good. The harvest of regulations which we now lace is undoubledly one which we ourselves planted. In my opinion, too many scientista lorgot that what leefs like freedom from the deck of a ship looks much more like arrogence when viewed from the ahore.

> Robin P. Riddihough Pecilic Geoscienca Canira Sidnay, B.C., Caneda

#### **Pondering Projections**

The accompanying ligure is an original 'World Mep of Oceans and Seas, plotted on ons of a series of new aqualerea projections (Mc8ryde S382). Shown on the mep ere the areas of the 200-neutical-mile exclusive economic zone (EEZ), in true size relationships to one enother. An equalarea map lor such use is preferable to the Mercator conformal projection employed by the U.S. Depertment of State for its original mep, which has been frequently reused, as in the September 1, 1981, 'The Oceanography Report' (David A. Ross, 'Marine Science and the Law of the Sea,' Eos, 62, p.650). This is e common miause of the invalueble Mercafor Navigation Chert. Merely ciling its high-letilude exaggerationa cannot begin to rectify the enormous scale and size expansions and is no substitute for graphic compera-

WORLD OCEANS AND SEAS 200-NAUTICAL-MILE ECONDMIC CLAIM ZONES (SHADED)

Source: Global Effect of 200 Nautical Maritime Zone Cleims
(on Mercator Projection)
Office of the Geographer, U.S. Department of State 1



McBryde 53 Equal-Area Decuonal Projection in Oceanic Lobes Designed, drawn and 1 1977 by F. Webster McBryde Approximate equatorial scale 1.515,000,000

The S3B2 projection map presents the entire earth/surfaca feetures in methematically true areel proportions, yat with minimized distortions of shape and scale, in oceenic sectione, each having en independent mid-meridien. Thie projection is composed of two other juxteposed equel-erea world projections: (1) ine Mercator Sinusoldal, for lower letiludes, with no scale error elong peraltels and mid-meridians, end (2) the McBryde-Thomas Flat-Polar Sinusoidel (derived from the first) for high letitudes, where extensions of polar lines one third the length of the equator reduce meridionel compression east-west. This improves areel shapes end provides more polar plotting spece. Straight, holizontal parellela efford all-Importent leilfudinal comparebillity. Such a mep is recommended for plotting all areel dete (e.g., the EEZ, oceenic depth zones, diatribution of blomess oi phytoplenkton, renges of botahical end zoological species and lormellons, sea ice, tectonio plates end irenchas, continentel shelf, slope end rise, mineral deposis, surface climetological dets, and the like). For directional end engular plottings, ea of winds, oceen currents, and

tides, the conformet Mercator is bast. (Note: These new equel-erea projections, though petentad, will be made evelleble at no cherge, upon request, lor any noncoming ciel, scientific use.)

> F. Webster McBryle McBryde Cantar for Human Ecology

#### Information Report

#### **COSOD** Opts for Explorer

With the withdrewal of industry support in the Ocean Margin Orilling Program (OMDP) (Eos. October 20, p. 7%) e glanf wave of uncertainty on the future of scientific ocean drilling swept over the oceanographic community. To slee the next decade'e programs toward sciantillic objectives, the Conference on Scientific Ocean Drilling (COSOD) was held November 18-18 In Austin, Tex. The conference (schedulad bafore tha industry decision) was sponsored by the Joint Oceanogrephic institutions for Oeep Earth Sampling (JOIDES), one of the principal operating arms of the Joint Oceanogrephic institutions, inc. (JOI).

A broad range of globel scientilic objectives were identifled that require e worldwide drilling progrem for at least the next decede, Roger L. Larson, chairman of the COS00 Steering Committae, told Eos at the meeting's conclusion 'Many of these objectives can be accomplished with the preesntly aveileble drill ship Glomar Challanger, but the ertended capabilities of the Glomar Explorer are required to accomplish a lerge number of other objectives. Thus, it was the unenimous consensus of the conference attendees that Glomer Explorar was clearly the preferable vessel for future scientilic ocean drilling."

This conclusion was one of the four basic options for OMOP that could have been reached: terminate ocean difing in 1983 (the end of the current phase of the Glomai Challengar's drilling); continue drilling with Chellenger lor another 5 years; substitute the Glomar Explorer for the Challengar to extend nonriser drilling; and use the Explore with full riser capebilities.

Larson edded that the conference participants recognized that the avellebility of Glomar Explorer was subject to a yet-to-be-conducted cost analysis and that the drilling eystem would elmost certainly be oparated without eriser and blowout prevention system for at least sevaral years. was elso recognized, he continued, that future ocean daily ing must be pert of a larger scientific program that includes adequate support for planning, site surveying, geophysical experimentation, and sample analysia.

This decision on the relative benefits of the two drill ships is the first of lour eteps enroute to deciding the future of so entilic ocean drilling, Allen M. Shinn, Jr., director of the Na tionel Science Foundation's Office of Scientific Ocean Drilling, told the conference perticipents. The other steps ea en asaessment of the capital investments required to refurbish the Challanger versus those to convert the Explorer. 'eccurete deta on the comparative long-run operating costs of the two ehipe'; end en aseessment of tha Tevel of commitment of our current end prospective IPOD [international Phasa of Oceen Orilling] pertnere.

Larson explained that COSOO succeeded to reemelgemate the IPOO drilling ellience. The conference was ellended by 150 eerth scientists representing the United States, the United Kingdom, France, the Federal Republic ol Germeny, Jepen, the Soviet Union, Norway, Canada, Austrelle, end The Netherlands.

COSOD also included workshop diacusations of the origin end evolution of oceenic crust; the origin and evolution of merine sedimentery sequences; the tectonic evolution of continented margins end oceanic crust; the ceuses of longterm changes in the atmosphere, oceans, cryosphere, ox ephere, end megnetic field; end tha tools, techniquas, end saccleted studies. Presentations from JOIDES panels ounded out the meeting'e agenda. On the basis of these workshops, ebout e dozen scientific priorities ware outlined. The COSOO Steering Committee was drafting its report of these priorities at Eos' deadline.

the test the pert of the tesk of ensuring that the objectives are met would preeumebly fell to JOI, a consortium of 10 ecademi oceenographic institutions. Formed in 1976, JOf described its duties as bringing 'the collective cepability of individual Institutiona to baer on lerga oceenogrephic raeearch projects. The Netional Science Foundation contracts with John Science Foundation c

to plan and cerry out OMOP's scientific ectivities. So that each member institution has a voice in the OMDP science progrem, JOI esteblished a Scientific Am sory Committee (SAC), according to William W. Hey, JO president, end Thomes A. Oavles, JOI chief scientist. To ald in its planning, SAC eppointed five regional planning; advisory committees and is in the process of formion in the technicel penels, which will be concerned with geophysics publications, logging and downhole meesurements, same curation end date managament, and leborelory facilities.

The primary objective for OMDP for the next few mobiles. will be in develop the science progrem. Hey and Davies emphasized.

In eddition to its OMDP responsibilities, JOI is charged with providing sciantific advice and guidence for the Dee Sea Drilling Project, under the aegis of JOIDES, and with carrying out the regional synthesis progrem, which involves the consultations. the consolidetion of geological and geophysical data con-lected during the last 20-30 years in 11 geographic regions targeted by SAC as candidate drilling citas, Hay and Da-yles explained. wes explained. The data include bathymetric gravimetric

and magnetic information, depthe as recorded by seismic reflectors, and descriptions of lithofacies.

The regional synthesis program involves epproximately two dozen institutions. Nothing on this scale has ever been done, Hay said. 'It will provide a solid basis for OMDP.' The actuel date synthesis is almost complete. Publication of the information, including maps, will be in approximetely 2 years, Hey estimated.-BTR

#### **News and Announcements**

#### Travel Grants Program

The Ocean Sciences Board (OSB) of the Netional Research Council is sponsoring a travel grants progrem for U.S. scientisia who are participeting in the Third Joint Oceanographic Assembly (JOA), slated for August 2-13, 1982, at Dalhousle University in Halifax, Novs Scotle.

U.S. sciantists, including U.S. citizens end foreign nationeis holding permanent vieaa, who need lunds to participate in JOA may apply. Scientiste employed by a laderel agency will not be considered. Travel grants will be based on round-trip excursion air farea plus registration fee. Participanis will be expected to find other funda for accommodalions and living expenses.

Applications will be evaluated by an ad hoc OSB panel. The panel'e criterie for selection are scientific merit of the contribution, importance of the contribution to the success of the assembly, age (younger adentiets will receive special consideration), end uniqueneas of the contribution or its valua for international research planning

Applications should be sent to OSB, National Research Coundi, 2101 Constitution Ave., N.W., Washington, O.C. 20418. Applicants should provide the following information inno more than two pages: nama; professional address; phone number; birth date; principal sponsor(s) of research; the of paper, poster aession, or other contribution (if an invited peper, specify session name and number and name of invitor); abatract of paper or poster; and any other informetion that will help in the evaluation. Applications must be received before January 1. Applicants will be notified on or

#### Selt Disposal Effects Found Small

8rine discharges into the Gulf oi Maxico averaging more than 600,000 barrels per day for the paat year have had 'iew significant effects' on the marine environment off the Taxes coast, according to a preliminary analysis by scien-13ts and engineers et the Taxas A&M Univarsity. The brine, 8 times aaltier than the surrounding seawater, is produced when salt from underground deposits on shore le dissolved and pumped into the Guif as pert of the Strategic Petroleum Reserve Progrem.

Lead by Roy Henn, Jr., of the Texas Engineering Experiment Station, the team is snelyzing discharge from Bryan Mound et Freeport, Tex., end from the West Heckberry site near Carneron, La. Affer e yaer of discharge off Freeport. the researchera lound 'no brine-caused differences in sediment temperatures and bottom-water dissolved-oxygen levels which sccompeny increased salinity, Hann seld. In addition, overall compositions of fish and shrimp remained

We are beginning to see a demonstrable, but not significent, environmental effect as a result of higher selinity, Henn said. 'A few fish may be evolding the discharge erea. but we ere sseing no deaths or other harmful effecte.' There were some effects on the density of plenkton in the eree, but Hann seld thase differences were not large when compared to normally high month-to-month fluctuetions in the plenkton population

The group also found that after more then e year ol discharge, records of salinity in the region 'were consistent with the overell physical oceanography of the area.' Nevertheless, most scientists involved agree that more enalysis Is needed before a final evaluation can be made.

#### Meetings

#### **CMOS Meeting**

The Canedian Meleorological end Oceanographic Society will hold its Sixteenth Annual Congress and Annual General Meeting at the University of Otlawa, Otlawa, Cannon, on May 26-28, 1982. The theme of the meeting will be Sea ice. In addition to invited end contributed pepers relating to the general theme, sessions will be held on other aspects of meteorology and oceanogrephy depending on contributions. Poster sessions may be held, depending on re-

Titles and definitive ebstracts (less than 300 words) should reach the program committee by February 1. Send material to George Isaac, Cloud Physics Research Division, Atmospheric Environment Service, 4905 Dullerin Street, Downsview, Onterio M3H 5T4 (telephone: 416-667-4683). Please indicate whether the paper is suitable for presentation in a poster session.

Tours ere plenned, and commercial exhibits will be on display. Organizationa interested in obtaining display space should contact Brian O'Donnell, Almospheric Environment Service, Ottawa, Ontario K1A 0H3 (telephone: 819-997-

#### Oceans 82: Call for Papers

The Oceans 82 Conference and Exhibition will be held in Washington, D.C., on September 20-22, 1982. The conterence's theme is 'Government, Industry, and Acedemia-Partners in Ocean Progress."

A call for papers hea been issed by the meeting's sponsors: The Marine Tachnology Society end the Institute of Electrical end Electronics Engineers Council on Oceanic Engineering. Requested ere papera that highlight lechnological potentials end problems where successful realization could make significant contributions and that proposo methods to foster ocean development. Among the 40 lopics expected to be discussed are geology end geophyaics, merine geodesy, ocean margin drilling, oceanographic ahlps, remote sensing from satellites and eircraft, seismic measuremente, and water quality and pollution. Workshops, panel discussions, end en extensive exhibit of marine products end services also are planned.

For edditional information and abstract forms, write to ceans 82 Technical Progrem Chairmen, Suite 412, 1730 M Streel, N.W., Washington, D.C. 20036. The deadline for abstrecte is Februery 14.

## MARINE SCIENCE

#### University of Miami

The University of Miamt is searching for a Dean who will serve as the Olrector of its oceanographic and atmospheric Institution which has 86 full-time faculty, 152 graduate and 305 undergraduate students, and a \$14 nillion budget. The main function of this position is to provide leadership to a thriving, multidisciplinary contmunity of oceanographic researchers and students, in duding biological, chemical, physical and geological oceonographers, ocean engineers, aimospheric scienitsis and specialisis in marine alfairs. The person who directs this institution will be expected to promote its aims and provide liaison with federal agencies as well as private loundations, and to encourage new programs to meet the needs of both developed and developing nations, especially those of the Caribbean and South

Applications, including a current professional resume, oinfinations and further information should be sent to Dr. Norman G. Einspruch, Chairman of the RSMAS Dean Search Committee, University of Minmi, School of Engineering and Architecture, P.O. Box 248294. Coral Gables, Florida 33124 Normations and applica tions desired by December 15, 1981. Position will renain open until filled

An equal opportunity affirmative action employer.

## **New Publications**

Thunderstorms C. Magono, Develop. Atmos. Sci., Elseviar, New York, x +

#### Reviewad by Pster V. Hobbs

in the preface to this book, Thunderstorma, the author points out that a researcher in etmospheric electricity would be herd pressed to provide a simple, auccinct answer to the question, "Why doee electricity form in cloude?" Certainy, siler come 200 years of research, the aubject is still nobrious for its prolificacy of theories and shortage of facts. Magono concludee, rather gloomly, thet future reaearch is kely to lead to even longer end more complex enswere to his quastion. A dieturbing prospect to enyone who believes hel obluscation generally conceels ignorence.

Howevar, the present book is designed to clarify rather hen obscure. It provides e etralghtforward review of observalional etudies and theories on charge generation in douds, lightning dischergee, and methode of protection against lightning. The treatment is largely nonmathematical and should be reedily comprehenable to the nonspecialist niliar with classical physics. There are only a few indicafions that the author'e first language is not English; he generously escribss this to the help of friends. Would that more scientists whose first lenguage is English could write so well in e foreign languege, evan with help.

The book begins with a short potpourri of subjects, induding the dynamics of thunderstorms, their microphysical and elactrical aiructures, and the dietribution of charges in flunderstorma. The aection on dynamics could have been lengthened if a cleer distinction had bean drawn between the various types of thunderstorms (airmass, multicell, supercell, etc.). The American reeder may be eppalled to find no mention of Franklin in the discussion of the electrical structure of thunderatorme. But the history of the aubject receives scan treatment throughout the book, a pity, since the author is in an excellent position to compare early westen contributione with less well-known atudies carried out in

The haart of the book is contained in chapters 2-4 ('Precipitation Electricity, 'Charge Generation in Thunderoms, and 'Non-Precipitating Thunderstorms and the Feed-Back Procasees of Electric Fielde and Precipitetion') lese chaptars provide detailed end up to date reviews of curent understanding in these aubjects. Most of the main heoriea for the electrificetion of cloud end precipitation par-Idas and thundarsforme are described, eithough the author sealthiy avoide committing himaelf to any one theory

Electricity, perheps more than most subjects, is plagued by the problem of units; data is generally, but not elways, presented in CGS units in this book. Is it too much to ask that (21 years after being accepted by the Internetional scientific community) publishere insist on the use of SI units?

Chapter 5 contains a clear and useful description of the structure of lightning discharges, thunder, and protection against lightning (the latter subject is elaborated upon in an

The book concludes with ahort accounts of some recent advances in the subject. This chapter, above sit, demonstrates that reaearch in atmospheric electricity is on the brink of breaking with tradition end moving into the era of modern meteorological research. Certainly, some of the most exciting advancee in the subject for several decades have come from recent studies in which observetions of the dynamics of storms have been mede simultaneously with measurements of cloud etructure and electrical activity. Also under the heading of recent activities, but not mentioned in this book, is the ability to observe lightning discharges worldwide from satellites and the observations of lightning on Venus and Jupiter. Mercilully, the reader is not to an eccount of the supposed role of etmospheric electricity in soler-terrestial effacts. Magono's intereste are more firmly rooted.

Paler V. Hobbs is with the Cloud and Aerosol Research Group at the University of Washington, Seettle, Washing-

### AGU CHAPMAN CONFERENCE

#### DISCONTINUITIES IN ROCK

May 3-6, 1982 Sante Fe, New Mexico Convenors: Lawrence Teufel and Robert Riecker.

Sessiona planned: Mechanics of formation end characteristics Constitutive laws and deformationel processes Geophysics phenomena Hydraulic propertiea Mechanical and hydreullo modeling

First announcement published in Eos, September 8. Deadline for application is Oecember 15.

# Coastal **Upwelling**

Francis A. Richards, editor

Coastal Upwelling, the first volume in AGU's newest book aeries, explores, studies, and reports on a vital part of our ecosystem through a multidisciplinary perspective.

Substantial progress has been made in identifying causal relations between physical and biological fields and processes. This progress oids in setting up consistent physical and biological data sets and models of the coastal upwelling

Topics include the environmental forcing functions and the physical, chemical, and biological aspects of the upwelling ecosystem.

Papers are, in part, derived from the IDOE International Symposium on Coastal Upwelling. Articles are also based on the expedition results of the Coastal Upwelling Ecosystems Analysis Program end similar research groups.

• 544 pages • Illustrated • Price \$23.00

American Geophysical Union 2000 Florida Ave., N.W. Washington, D.C. 20009

Cail 800-424-2488 toli free 462-6903 in the Washington, D.C. area

20% mamber discount

Orders under \$50 musi be prepaid,

Standing orders are welcome.

### Classified

EOS offers classified space for Positiona Available, Positions Wanted, and Services, Supplies, Courses, and Announcements. T are no discounts or commissions on classified nds. Any typa that is not publisheds choice is charged for all display rates. EOS is published weekly on Turrorkry Ads must bu recuived in writing on Monday 1 week print to the date of thir

Replies to ade with box numbers should be addressed to Box , American Geophysicial Union, 2000 Flortda Avenue, N.W., Washington, D.C. 20009

POSITIONS WANTED Rotes par lina 1-5 limas -\$1 00, 6-1 f limas -\$0.75, 12-26 limos -\$0.55

POSITIONS AVAILABLE Rates par lino t-5 limos-\$2.00, 6-11 llmes-\$1.60, 12-26 timea-\$1.40

SERVICES, SUPPLIES, COURSES. AND ANNOUNCEMENTS Rates por lina 1-5 limes -\$2.50, 6-11 times -\$1.95, 12-26 Imes-\$1.75

STUDENT OPPORTUNITIES For special rates, query Robin Little, 800-424-2488

#### POSITIONS AVAILABLE

University of North Dekate. Applications are mailed for has tenuro-track appointments in the De-partment of Geology, togething January 1982.

[1] poiroleum griology or rolated holds [2] one of the following aleas low-temperature greechemistry carbonato potrology The first position will include teaching 1 or 2 courses per year in polrolouin geology. Doth posi-tions require leaching undergraduate and graduate courses in the creatst of expense, diructing grantuato student repeatch at the MS and PhD levels.

and developing nit active regularest program.
The Occurrent has nine full-time firculty, two adjunct laculty, about 150 undergraduates and 50 graduate students. Association with the North Ua-kola Oeological Survey Includes access to complute subsurface records, cores and sample a for 9,000 wells in the Williston Brisin. Proximity to the Williston Basin and Canadian Shield provides abundant opportunity for research in sadimentary, ignove, and moternorphic petrology, and oconomic genlogy. Excellent physical facilities, the state core and sample library, and excellent photo, mep. and book collections are evalished

The Ph.D. is required, selary and rank are open end compositive Applications will be accepted until sulfable candidates are found. Applicants should submit complate resumes, including education, pigyous experience, leaching and research interests. and at least three letters of role and to

Dr Richard O LaFever Chairmen, Search Committee Department of Geology Grand Forks, ND 59202

Seeth Dakete School of Mines and Tochnology. Applications or a invited for two positions in the Oepartment of Geological Engineering Both implies leaching of undergraduate and graduate levels. Thesis direction and devalopment of ra-

Geological Engineering specialty in rock or cooxycal Engineering specially in rock or soft machanics, site aveluation, geohydrology, patroleum reservor anginaering or enginearing saurrology. Industrial dosign experience helpful. A Ph.D. in some eroc of angineering is preferred. One Deposits area of specialization is open. The successful angle and will work cleastly with the

The successful applicant will work closely with the nawly established Institute for the Study of Mineral sits The Ph D. is required.

The Ospariment has en undergraduato onrollnent of 170 majors and a greduate anrollment of 60. Fia'd epplications of geology and angineering are emphasized interasted persons should send rasume and three letters of recommendation to. Atvs Lisenbee, Dept. of Gaology Geological Engineering, South Dukota School of Minaa and Toch-Rapio City SD 57701

SOSMAT is an equal opportunity employer Rescerce or Mineral Economics. The Departmont of Engineering and Public Policy of Carnegla Mellon University is seeking to add a new er at the luvel of assistent prolessor in resource or mineral economics to work in chilaboration with engineering based research programs primarily in materials policy but possibly also in hazardous minionals, energy systems, and or unvironmental aysteins. There are reasonable prospects for a joint academic appointment with either the School of Urban and Public Affairs or the Ocpanment of Social Scienco. Seno rusume with list of publications and statement of research interests

Or. Inden. Na r

Department of Engineering and Public Policy Carneg u-Mellon Univer C-MU is an equal exportantly employer

Princeton University. A research position is available beginning 1 January 1982 in the Department of Octological and Geophysical Sciences for work on the effects of the etmosphere and oceans on the Earth's variable rotation. Past expenses if Earth rotation problems and apphal geodesy techniques as wall as familiarity with melector data sets is required. Sand resumes to F. A. Deh-len, Department of Geological and Ocophysical Sciencos, Princeton University, Princeton, N.J.

Princeton University is art equal opportunity offirmative oction employer.

Paguity Position in Geophysics/Strusiure Ossicgy/Engineering Goology. The Department of Geological Sciences of Case Western Reserve University in Cleveland, Oho is seeking candictators to lift an enticipated faculty position in the hroadly defined eross of geophysics alructural geology engineering geology. While field of specialization is open, the successful condidate will be charged with conducting the Department's teaching programs in geophysics at the greduate end under-praduate layels, in addition to cerrying out e vigor-ous research program. Ample opportunities exist for research colleboration both within the Oppartmeni of Geological Sciences and with laculty mam-bers in the School of Engineering Ph.D. or equivelent is required. Please submit

applications, consisting of resume, names of three eronces and n slotement of research end teach-Semuel M. Sevin

Depertment of Geological Sciences Case Weatern Rosetve University Cleveland, Ohio 44106 Caso Weslem Reservo University is an equal op-

portunity effirmative action employer Streaterel Geology/University of Iffinels et Chempelgn-Urbane. [Search reopened) The Goology Department is easking a structural goologist for a tenure-track (assistant professor) feculty position A Ph.O is required. Selery open. The successful candidate will be uxpocted to teach advanced undergraduate and particular structures. vonced undergraduate and graduate courses in elruclutet goology and establish o research pro-gram. For equol consideration, opplications, including the names of three refereus, should be sent by February 1, 1982 to Dr. D. E. Anderson, Capariment of Geology, University of Illinois, 245 Netural History Building, 13D1 Wost Groen Stroot, Urbeno, IL. 61801-2999, (217) 333-6713

Position to be filled by September 18, 1982 The University of Illinois is an effirmative action?

Hydrologyr Tenure Track Position et Aseleteni or Aesociela Professor Lovel. Candulate should be a specialist in some quantitativa aspect of hydrology with demonstroisd skills in formuloling hydrologic medals, and a background in omenni Academic or prof credentials at Ph.D. level required. Starting date negonablo but could be as early as August 1982 Hosumes, etc., should be roceived by Morch 1, 1992 Interosloci persons should request job do-scripton from Dr. E. S. Simpson, Chairman, Search Committee, Department of Hydrology and Water Resources, University of Artzona, Tucson, Artzona 95721

Equal opportunity affirmative action amployer Seegoing Reeserch Assistant in Physical Ocaanography. Applications invited to raposition in the School of Oceanography. Oregon State University D.S. in physics or engineering Must have sone going experience needs some lamininity with computers and alectronic instruments. Must be able to essume position by 15 February 1992. Appoin-tee will leke responsibility for deployment of a wa-ter-structure profiler on a cruise in May-June 1982; will take responsibility for preparetion, calibrations, work at see, and praparation of the date report. Salary \$20,000 or or more depositions of propri Salary \$20,000 yr or more depending on experiance. Submit application and names of three rafer-

ances by 25 Dacember 1981 to: Douglas R. Celdwolf, School of Oceanography, Oregon Stele University, Corvallis, DR 97331

An affirmative action equal opportunity amptoyer Patrology: Geochemietry: Floride Internetional University. Applications are invited for one tenure track position lassistant professor avoisble from August 1982. The successful candidate will be expected to teach at the undergredual date will be expacted to teach at the undergreduate level and puratual a vigorous research program. The applicant ahoutd have a beckground in petrology and geochemistry. Highly qualified candidates in the axes of geophysics or hydrogeology may also be considered. Applicents should have a Ph.D. degree. Closing date March 15, 1982. Applications in cluding a curriculum vitae. ctuding e curriculum vitae, research interests, and

three letters of reference should be sent to: Dr. Leonard Keller, Cheirmen, Depertment of Physical Sciencae, Florida International Universi-Temami Trait, Mrami, Florida 33199. FIU is a mamber of the State University System

of Floride end is an equal opportunity effirmative The crotice! Ge ophysiciet/Getemologief. The Department of Geological Sciences at Southern Methodist University is eaching to full a laculty posi-tion to astablish programs of research and gradu-ata-undergraduata taaching. A position will be filled in one of the following halds: in one of the following helds:

[1] Theoretical Geophyeicist—possible helds of interest are inverse theory, digital date process. ogy, gravity magnatics; or oloctrical methods pre-

121 Solsmologist--preferred interests in reliection snismology, possibly in deta acquisition and interpretation, industry experience and or willingnosa to intoract with local exploration geophysicials

These positions are part of a program to expand the salpositions are part of a program to expand the orising goophysics group which constats of two sensor laculty members, severel (Ph 0.) research associotes and technicians. The Mathematics Department has on excellent numerical methods group of four faculty members which ancourages infaraction with the applied ecrences. Computer facilities are excellent consisting of CDC Cyber 73 and CDC 6600 main frames with remote access CRT. Tektronix grephics and herd copy terminals within the Department The Department else houses e Nova 4, a POP II, ceverel other minicomoutera end is in the process of instailing a VAX ava-tern for geophysical date processing. Several major oil company research groups are based in Dallae. interaction with these end other local geophysicists is encouraged together with a reasonable amount of consulting. Academic renk and salary are negotiable and considerable flexibility axists in this area.

Send resume and names of 3 references to M. J.

Holdaway, chairman, Department of Oeological Sciences, S.M.U., Dallas, TX 75279. S.M.U. is an affirmative action equal opportunity

Yele University/Department of Goolsgy and Gesphysics. Applications are edicited in e laculty position in solid earth geophysics to begin in the academic yeer 1982-83. Areee of Interest to the Department include selsmology, exploration geophysics, machanical and physical properties of geophysics, macnanicer end properties, and tectono-rocks and minerels, geomagnetism, end tectono-

Ysle University is an equal opportunity/effirmative ection smployer and encourages women and mem-bers of minority groups to compete for this position. Curriculum wise, publications and the names of three or more releress should be sent by 31 Os-cember 1881 te Robert B. Gordon, Chairmen, Osparlment of Geology and Geophysics, P.O. Box 6868, New Haven, CT D6511.

Physisel Oceanographer. Royal Roads Milllery College expects to have a tenure track vacan-cy in Department of Physics effective 1 July 1982. dates should hold doctore or near doctore in physical oceanography prelerably with experi-ence in digital hardware and microcomputer appl cations. Appointment expected to be made at essietant prolessor level but ealary and rank depen deni on qualifications and experience. Relocation expenses can be provided. Duties include under graduate teaching in physics and physical oceanography, and research in marine science. Applice tions should include complete dossier end neme tions should include complete obsault for or. E.S. of three references end be sant to: Or. E.S. Greham, Principal, Royal Roads Military College, FMO Victoria, B.C. VOS IBO.

The competition is open to both men end woman Knowledge of English onty is required. Only Ca-nadian cilizens or Landed immigrants need apply. Toute information relative à ce concours est dis-ponible en Irençais et peut être obtanue en écrivant

lowe State University of Science and Technology/Department of Earth Sci-

Applications ere invited for two lenure frack laculty positions. The renk for each is el the eestetant or essociate professor level, dependent upon qualifications. The successful applicants will be expected to develop strong research and greduete etudent progrems. Teeching duties will include undergradu-

e end greduele courses in the areae of expertise Mineral Resources Economic Geology: One post-tion is in mineral resources/economic geology. An epplied lield orientetion to prefened, lowe State has established at Mining and Mineral Resources Research institute and an interdeperimental minor in Mineral Resources in order to present the state of the state o Mineral Hasources in order to support and develop research end education in this erea, in eddition to the appointment in the Cepartment of Earth Sci-ences there will be full opportunities to interact with

phology: The second position is in the Geomorphology: The second position is in the general field of geomorphology. Additional exper-lise in an erea retetad to geomorphology, euch as groundwaler, anginearing geology or remote sens-ing is also desired. A person with an applied field

oriantation le being sought.

Each appointment will be on an academic year basis. Opportunities are available for summer leaching appointments. Salariee will be commensurete with qualifications. Application deedlines for both coations are Sehree. 15, 1939 letter applicaoth positions ere February 15, 1982; later epr tions will be accepted if a position is not lilled. Posi-tions are both currently available and are expected lo be filled no faler than Iall, 1992. For application tion plasee write to:

Bert E. Nordle Osperiment of Earth Sciences 253 Science I

lows Stele University
Ames, lows 50011
lows Stele University is an aqual opportunity/ef-

Serficial Geology/Ground Weter. Uteh State University. Tenure treck position sterling epring quarter of 1982 or fall quarter of 1982. Ph.O. epring quarier of 1992 or fall quarter of 1982. Ph.O. required. Renk and estery negotiebts. Surficiel geology with emphesis on geologic field studies and ground water with attention to both geologic end geohydrologic aspects. Emphasis on the end West. Closing dete November 3D, 1981. USU is en affirmative action agreed consciouties appears. Deport metive action equal opportunity employer. Department of Geology (D7). Utah Stafe University, Logan, Utah 94322.

### POSTDOCTORAL **POSITION** IN MARINE CHEMISTRY

Wooda Itole Oconnographic Institu iton invites applications for the position of Postductoral Investiga-tor. This position is being offered for baule research on the chemistry of the portlete flux in the neese end or the chonsistry of sediment-seswater inisractions, with particular emphaale on the transport of trace maials and radionuclides. Preference will be given to appliennts with training in rediochomistry, Irace-olamen nnolyels, surfore chemistry, or geochemieni modeling. Send resume and names of three references to:

Personnol Mnnogor

WOODS HOLE **OCEANOGRAPHIC** INSTITUTION



Woods Hols, MA 02543 An equal opportunity employer M/F/H

Ocae ne grepher. GS-1360-12, Salery \$28,245-\$39,723. The Remote Sensing Brench of the Nevel Ocean Research and Osvelopment Activity (NOROA) is seeking quelitied applicants for the postiton of Ocaenographer Outres include. Serving es principal investigator for planning and organizing basic and applied acientific invastigations of radio probing of the oceen surface, and interpreting the results of these investigations in terms of oceawill include the detection and anelysis of ocean fronts and eddles through the use of eatelfile-borne ellimetere. Responding to Announcement No. 91-039, send a current SF-171 no leter (han 21 December 1991 to the Civillen Personnel Office (Coda 140Al, Nevet Ocean Research and Development Acimity, NSTL Sletion, MS 39529 or catt 601-686-4541 lor appropriate forme or additional informa-

An EEO Employer. U.S. Citizenship Required.

Plenetery Solantict/Washington University. The Oepartment of Earth and Planetary Sc-ences has aveilable a tenure track or tenured positien beginning in the lelf of 1982 for a geoscientist with research interests in such erees as planetary geophysics, planelery materials, or plenalery el-mospheres. Preference will be given to research erees that complement the current departmental

The successful candidate must have the lollow ing ethibutee: demonstrated creetivity and promise of excellence in research end froling; inlent to develop e vigorous greduete rosearch progrem; desire to teach courses in field of interest and ralated fields of geoscience et undergraduete ond graduale

Send resume, statement of luture research interests, and names of at least three references to Lar-Haskin, Chelimen, Oapartment of Earth and nelery Sciences, Washington University, St. Louis, MO 63130. Applications received through

Ingion University is an equal opportunity/at-Hrmative ection employer.

### Vincent C. Kelley and Leon T. Silver **Graduate Fellowships** DEPARTMENT OF GEOLOGY THE UNIVERSITY OF NEW MEXICO

The Daparlment of Gaology of the University of New Mexico Invites applications for the Vincent C. Ksiley and Leon T. Silvar Graduste Fallowships. The fallowships will be awarded on the basis of the scholaetic record and academic promise of graduate applicants. Each diowahip will provide for a generous living stipend of \$1,000/month for 9 to 12 months, and up to \$2,000/year for traval and reassrch expanses. ha Caawali Silver Foundation will pay all fultion and university faes. The awards are made on an annual basis, but may be renewed for up to thrae years as long as the student maintains excellent academic atending and ahows evidence of significant progress in research. Preference ba given to, but is not restricted to, applicants for the Ph.D. program.

An application for admission to the UNM Graduata Program, trenscripts Graduata Record Exam rasulta (varbsl, meth & gaology), three latters of rafaranca and s briaf alajament of research goals are required for consideration for the fallowahips. Application materials may be obtained Rodnay C. Ewing

Dapartment of Geology Univaralty of Naw Maxico Albuquerqua, New Mexico 67131



line for applications is Merch 1, 1982 for the Fall earnestar of 1982.

Lshigh University. Reaearch Associeta | Post Coctoral) position involving e study of the geo-chemistry of metacritic metaclic phases. Solidifice experimenta are planned with Fe-NI-S-P-C relly importent minor elements-ir. Oe. Au, elc Goel le to investigate behevior oi particuler elements during the scridification of the core and men-te dissignification of the core and men-The position is evallable etter Jenuary 1, 1982.

action employer. Sand vite and the names of three references to Professor Joseph f. Goldstein, Department of Melellurgy and Materials Engineering, 86g. #5, Lehigh University, Bethleham, PA 18015. Research Associate/Theoretical Physical Acesnogrephy. Applications invited for two pos rch sesociate positions in the School of Oceanography, Oregon State University. Appli-card will conduct research in theoretical modelling and observerional comparisons of ocaen circula-ton, Ph.O. in mathematics or the physical sciences. Submit resume, brief statement of research interests end three references by 1 Jenuary 1982 to Prof. Pears P. Niller, School of Oceanography, Oragon Siela University, Corvailis, Oregon 97331. An affirmative action/equal opportunity employer

Lehigh University in an equet opport

Structure! Geologiet ar Ozophyelolet Washington University. The Department of Earth and Planelary Sciences has available a lenurs track or tenured position baginning in the fall of 1982 for e structural geologist or geophysicist. Prej-eence will go to candidates with research interests billed studies or measurements perteining to the emston end evolution of continental crust. Interests of the candidate should complement those or pasent leculty in geochemistry, geophysics, and consmic geology of Precambrian regions. The successful cendidate must have the follow-

incutes: demonstrated creativity and promise al sicellence in research end teaching; intent to develop e vigoroue greduala research program; de are to teach courses in field of interest and related tids of geoscience at undergraduate and graduate

Send resume, statement of future research inter-ess, and names of at least three references to Lery Haskin, Chairman, Oepartment of Earth and Panelary Sciences, Washington University, St. Louis, MO 63130. Applications received through February 15, 1982.

Washington University is en equal opportunity etlanding action employer.

Kelamorphic Geologiat. The Oppartment of Earth Sciences of Montena State University anticipaies e new position in geology and invites explica-tors for a tenure track position at the assistent prolassx leval beginning either June or September, 1982. We seek a lield-oriented metemorphic geolo 4st Abeckground in economic geology or tectonas is desirable. Candidates must be interested in leaching introductory geology and undergraduate melelogy-patrology courses, and will be expected to participate in summer field instruction. Compleion of Ph.D. prior to eppointment is alrongly pre-lened. Our department hee 11 faculty and is multidsoptimery. B.S. options in gaology, geophysics, segraphical planning, geography, and meteorology and an M.S. option in geology are currently ol-

Send resume, transcripts, and three letters of recommendation by February 10, 1992 to: Dr. Robert A Chadwick, Department of Earth Sciences, Montana State University, Bozeman, MT 59717.
Vontana State University is an affirmative action/ equal opportunity amployer.

niversity of Howalis Faculty Positions. The Department of Geology and Geophysics and the Hawell Institute of Oacophysics of the University of Hawell are seeking applicants for two tenure tisk positions becoming aveilable Jenuary 1, 1382. Applicants should have apecialization in (1) manus geophysics with emphasis to one or more of te lieks: marine eelsmology, magnetics and gravi-ty.c: (2) marine geology/eadimentology. One of test positions will be litted at e rank of full professx, the other at assistant or essociate lavel. opiicanis should have demonstrated ability to trodict and promote marine research commencu als with the tevel of the epplication. Ability to teach il el levels to expected. The positions will be joint ens on an 11-month basile with the Ospariment and the institute and will involve both teaching and the institute and will involve both teaching and itsearch responsibilities. Apply with resume, expected level of appointment and the names of 3 reverse to Chairman, Personnal Committee, Department of Ocotogy and Ocophyaica, University of Itaxai, Honolulu, Haweii 99922.

Cosing date for epplications in January 1, 1982. The University of Hawaii to en affirmative-action/etgal opportunity ampliture.

etrologiei-Economic Minerelogiet/Univerally of Dkiehome. Applications are invited for a largue-track position, effective September 1, 1982 ivel, in petrology an omic minerelogy. The auccessful applicant is especied to leach graduate courses in his/her spedaly, to help leach undergraduate courses in min ing companies are encouraged.
The University of Oklahome has made a major

niment to diversity the program in the School kingy & Geophysics. As e result five tenurelitione are open for the last of 1982. Six ituity were added to the School in the lett of (bringing the total full-time faculty to 15), and simple elements of the following the total full-time faculty to 15), and total elements of the following t 1986. A new building that will house the is in the design stage, and the euccessful will participate in equipping it.

The Ph.D. dagree is required for this position. will be given to petrologiste with e chemistry background and with e demon-strate in the economic geology of metalic non-metalic mineral deposits. Qualified appli-ts should arrange to send transoring of all cold university work, reauma, statement of ren interests, and three letters of reference to: Maryeten Cameron, School of Oeology and Geophysics, University of Oktahome, Norman, Cathons, 73019. Deadline for epplications is December 11 1991. amber 31, 1981. Faculty members from the Acting in Circlinal, Ohio, and at the December. (Q)), meeting in Sen Francisco, California.
The University of Oklahoma does not discriminate on the basic of race, or asx, and is an equal

whinly employer.

Physical Oceanographor. The School of Oceanography. Oregon State University. Is soliciting applications for en easistent or associate prolessor, depending on experience. Applicants may be observed on aliste or theoreticiens, but must have e Ph.D. in the physical sciences and have demonatreted ability to conduct independent high-quelity research end obtain research lunding. Duties include leaching end approvision of graduate students interested candidates should submit a resume and names of three references by 1 Jenuary 1882 to: 0. Ross Heeth, Deen, School of Ocoanog-raphy, Oregon Siete University, Corvells, Oregon

Affirmative Action: Equal Opportunity Employer

Selamologiat/University of Uteh. 9earch extended: the University of Utah le expanding its geophysics program in the Department of Geology and Geophysica by edding a tenure freck laculty. mamber in seismology et the eseistant to associete professor level. Applicants with beckgrounds end specielities in seismic rellection, seismic imaging. end theoretical seismology will be given prelarence The individual will be expected to leach undergrad-uete end graduete courses, end to pursue an active research program with graduate students. The de-partment has modern teaching and research pro-grame in geology and geophysics, and has close tione with the numerical energys and date processing groups in computer science, electrical engineering and methemetics. The geophysice component of the department has strong resec end teaching progrems in saismology, elactrical end electromagnetic methods, thermal properties of the earth, end potential lields. Current research in aeismology includes: selsmologicet end earthquake research utilizing a new PDP 11/7D computer with plotter and terminale; monitoring of the infermounteln seismic belt by a 55 station telemotorad notwork utilizing a new on-line PDP 11:34 computer mejor expanments in selemic refrection profiling, it vestigations of earmic propagation from synthetic selamograms, application of inverse theory to selamology, seismic properties of volcanic systems and ellied research in tectonophysics. The closing date lor applications to December 31, 1991. A Ph D is required for this position. Applicants should submit a vite, transcripts, a letter describing his hor research and leaching goals, and names of tive per-eons for reference to William P. Nesh, Chairman, Capariment of Gaology and Geophysics, University of Uteh, Salt Lake City, Utah 94112 University of Uteh is an equal opportunity affirma-

live action employer

Positions in Oceanography/VIM9. The Virginia Institute of Marine Sciance (VIMS) School of Marine Science invitos applications for two state lunded, oceanography research and teaching posi-tions at the lavels of Senior Menne Scientist VIMS is a broad-based merine science astablishment with a mission to provide sound and limely advice to executive agancies and the legislature and to conduct incisive research progreme. The School of Merine Science offers M.A. and Ph.D. programs with a laculty of 99 and 139 graduete students HEAD, OEPARTMENT OF OEOLOGICAL

OCEANOGRAPHY |#1131 Applicants are sought with research interests estaurine sedimentery geochamistry, dynamics of cohastve sediment trensport, or estaurine and coestal morphodynemics. For further inform contact Dr. Robert Byrne (VIMS), 904/842-2111 (Ext. 173). ESTUARINE AND COASTAL HYORODYNAM-

ICS (Position #204) A physical oceanographer with a strong interest in interdisciplinary epproaches to complex estuerine and continental shell problems is dealred. For further Information contact Dr. 9ruce Neilson (VIMS).

604/642-8131 (Ext. 244). Cendideles for both positions should have eateb-Rehed research credentials and be dedicated to furthering the research end educational progrems of the institute. Demonstrated ability to generale ex-fremural support to expected. Balary range is \$24,972 to \$34,107 and leculty rank is commensu

Applicants should send a comprehensive curricu ium vita, reprints, and el least three latters of recommendellon by February 1, 1992, etating apecific position of interest, to: Employment Manager, Personnel Office, College of Wm & Mary, Williemsburg, VA 23185.

An equal opportunity/affirmative action employer.

Structural Caclogist/University of Wyoming. The University of Wyoming, Oepariment of Gaology and Geophysics seeks epplicants for a fanure track eppointment in structural geology ex-pected to be evalleble beginning fall semester 1992 or earlier. Outles will include teaching of undergraduate and graduale courses in aiructural geology, supervising MS and PhD theses, end research in sor level la praierred, but epplicante requesting ap-pointment at higher renk will be considered. Salary ed in quantiletive theory as well as field applicellons or modern structurel geology and regiona

Applicants should provide, by Jenuary 1, 1992, a reaume, three isiters of reference, and e latter of application including a eletement of current reserch injerests and courses which the applicant feels quelified to teach. Applications should be sent

Dr. Robert 6. Houston/H Opportment of Geology and Opophysic University of Wyoming Leramie, Wyoming 92071-3006. The University of Wyoming is an equal opportuni-

Herine Goordinetor/University of Soeth Florida. Beccalaureale degree in a science, MS end/or 5 years experience in oceanography or a re-lated field, Musi be (1) oble to supervise the work of a technical staff of 1D, (2) able to do budgalary accounting, and (3) thoroughly familiar with equip-ment and logistical problems and solutions in mafine solance. Salery range \$18,000-20,000 per annum. Application deadline is December 31, 1981. Apply with resume and references lo:

erimani of Marine Science University of South Florida 140 Seventh Avenue South St. Petarsburg, FL 33701.

lverelly of Utehi Faculty Pacifione. Tho Department of Geology and Geophysics invites no plications for four tenure track positions at the es-

alstant to associate prolessor leve 1] Economic Goology: The specific erea of exparliso is open, however, profesorous will he given to candidates whose research interosis aro in geological, geochemical, or per-relegical characteristics of motolic mineral

relogical charecteristics of motolic militaral deposits
2) Sedimentary geology: Applicants should have research interests in modern or nuclent sedimentary basins.
3) Seismokey Applicants with backgrounds and specialities in seismic reliaction, soismic imaging or theoretical seismotogy will be given preference.

given preference.

Polantial fields Goophysicist with spacielty in polential theory including gravity and magnetica. (The closing date for this posi-tion is January 31, 1882).

A Ph D. or equivelent is required. The vacancies are to be filled by Baptember 1982; the clasing dele for applications for positions 1-3 is December 31, 1881. Applicants should submit a vita, tmnscripis, e letter describing his har rosearch toe ching goals, and names of live parsons for reference to William P. Nash, Chairman, Department of Geology and Gaophysics. University of Uleh, Salt Lake City. Uleh 84112

The University of Utah is an equal opportunity niirmelive eclion employar

Princelon University/Water Resources
Program, Dopertment of Civil Engineering.
Department of Civil Engineering Invites applications for a tenuro track, throo-your appointment at the assistant professor rank beginning on or before September 1982. Responsibilities include graduate and undergraduate teaching in hydrology and water rosources, and participation in resumed into nether hydrological processes nasociated with inhitration and unanturated flow or channeal processors and transport in the unanturated zone. Carabidate transf have Ph.D. degree with demonstrated feaching ability and scholarship

il resumo and references h Eric F Wood, Director Water Rosources Program Department of Civil Engineering Princeton University Princeton, NJ 08544 Princeton University is an alternative action equal

apportunity amployer **Gsophysical Fluid Dynamicist Physical** 

nographor. Applications are solicited for a junior faculty position in ocean physics or dynamics to begin in the academic year 1982-83. Areas of interest to the Department include analytical, pr merical and laboratory modeling of physical prog-asses and phenomena in the sua

Yalo University is an equal opponunity affirmative action amployer and encourages women and mem-bors of minority groups to compute for this position Curriculum vitae, publications, and the names of three or more referees should be sent by 31 Docembar 1981 to Robart 9 Gordon, Chairman, De parlment of Geology and Geophysics Pro Box 6666, Naw Haven, CT 06511

Research Associate Position University of Arizons. The Lunar and Planolary Laboratory anlicipales their a postdoctoral position will become eveilable in January 1982. This is a one year, nonrenewable position. This position will involve laboratory studies of the infrared spectral reflectances of neteoritae, terrestrial silicates and icas. These data will be used for interpretation of high-resolution spectra of esteroids and other planet satalities. Ap plicant should have experience with IR apactromaters at the teleacope and in the laboratory
Vita, bibliography, and three latters of reference
should be sent by December 31, (99) to

Dr. Larry A Lebolsky Lunsr and Planetery Laboratory University of Arizona

Equal opportunity/effirmative action Title IX Section 504 employer. Feoulty Positions. Two Faculty Positions in Geology. Tanurs-frack positions in geology, assistant professorships. Ph.D. preleired or equivalent xperience. Falt 1982.

Petrologisi-Mineralogist. Candidele muel be able to leach introductory geology, mineralogy, petrology, geochemistry, and optical mineralogy/pe-

Candidate must be able to teach courses in inverte-

hon, end historical geology. Additional exportise in

recont merino environments highly desimble
Applicants ore expected to do research in their areos of experience, and to lead students' lied tops Strong teaching and research commitments expectod Submit applications with resume and copies of transcripts, and have three tailors of recommenda-tions sent to the Chairperson, Detruthment of Earth & Space Sciences, Indiana University-Purriue University at Fort Wayns, Fort Wayne, Indiena (D805 Indiano University Purdue University is an equal opportunity offfrmative action ampleys

#### STUDENT OPPORTUNITIES

Earth and Pienelary Sciences, Massachuestte instilute of Technology. Our Depart-mont has research and teaching assistantships evellable for new graduate atudents enrolling in September 1982. Research opportunities encom pass a wide range of topics in planetary sciences. geophysics, geology, geochemistry, and potrology Students with undergraduate majors in geology. physics, chemistry, mathematics and angineering nro encouraged to apply. Dotated information can be obtained from Debby Roacker, 51-912A, MTT. Cambudga, MA D2139, [917] 253-3380

Graducie Research Assistantships in Physicat Oceanography. Opportunities for graduate study with Research assistantship avail able for students interested in M.S. or Ph.D. pro-grams. A summor program with stipund is open to callege juniors. Write Douplas Califwell, School of Oceanography, Oregon State University, Corvollis
OR 97331

Oreduste Assistantships Pallawships in Applied Peleomagnotic Rossarch. Opporhindres for study, with research insistant-hips available for students internstert in M Sc. or Ph D programs of the Columbia School of Mines Hosearch inpics combit around applied paleomagnet invusingations in economic geology, structural goalogy and straligraphy diageness and histade such areas as the Stillwater Complex, western (Cenezula volunics philons) and eastern (coru complexes) Basin and Rango, coultal Colorado and the Powiter Rivor Basin. Students with undergraduate majors in goology, geophysics and physics are encouraged to apply. Detailed information can be obtained

John Goissman Coloratio School of Mines Golden, Colorado 80401 (303) 279 0300 Ear 2860

Graduato Taaching & Research Asalstaniships University of Houston. Graduate teaching & research assistants leps available to qualified persons interested in Space Physics at the University of Mauston. Our experimental pro-gram features mocket & half-our borne studies of the onesphere & magnetor plante-remosphere coupling Emphasis has been on active experiments, most rocent being a rockol-halloon campaign at Style station. Antarctica in December 1980 Future worl includes a study of pursating nursers & purificination Waterhole II an auroral quenching experiment The theoratical program is on plasma nures in the solar wind & modeling of phenomena related to current experiments. Assistantships for list year students begin at \$600 mp along with out of state fullion wayars. Graduate Chairman, Physics Dept. University of Houston Central Campus Houston TX 77004 EQE

#### SERVICES

PETROLEUM DEPOSITS. If you are financing planning, designing, exploring, drilling, or digging in connection with eny form of energy, you need this complete, up-to-date book about the world's patrofeum deposits. Includes production end reserves for areas Hardcover. 6 - 8 Inchos. 378 pages Toble of contents, drawings, Index, references, 1974. \$50 Taisch Associates, 120 Thunder Road, Sud-

EST SERVICES. Scientific Translationa From Russian to English. Specializing in Hydrology, Water Resources, and the Eerth Sciences: pure research, engineering, construction, systems analysis, mathematical modeling. Experienced, extensive academic training. 15 years profassional experi-ence ea a geohydrologist Donald J. Percious. 3219 Camino del Saguaro, Tucson. Arizono 65706 (602) 743-0863.

### Latest Releases from AGU

-Hindu Kush-Himalaya-Qoo dynamic Evolution (1981), F. M. Delany and H. K. Gupla, aditors, illustrated, loldouis, separsts maps, 332 pagea. \$28.00 (GD0300). Geodynsmics Series.

Presants data on the leotopic dating of Himalsyan rocks and discusses the geostry of an undistributed ophicitie seguance. Rassarch includes: Focsi mechanism solutions and their tectonic implications for the antire region; the problems of salsmidity and conlinental subduction elong tha Chaman and subsidiary laulis; plua surlace wave dispersion and allanuation studles for the entire region.

Anelasticity in the Earth (1981), F. D.

Stacev. M. S. Palarson, A. Nicolas, edi-

(GD0400). Gaodynamics Series. Recent progress in the study of slow deformation by the processes of mentile con-

lors, illustrated, 128 pages, \$15.00

2000 Flonda Ave., N.W. Washington, D.C. 20009

S American Geophysical Union

Call toll free 800 424-2488 or in the Washington, D.C. area 482-6903

vection and the correlation between high attenuation and low resistance to creap is amphasized in this volume. Preliminary conclusions derived from laboratory observalions on ollenuation Indicate the imperlance of crystallina dafects, especially dislocations. Thus crystal dislocations may be responsible for both the plasticity and analasticity of the mantle. Current opinion is scrutinized and new observetions are prasenied in this collection of reports.

Evolution of the Earth (1981), O. L. Anderson, R. J. O'Connell, W. S. Fyla, E. A. Labimova, editora, fliustrated, 300 pagas, \$19.00 (GD0500). Geodynamics Series.

Reports on the current state of research into the geophysical and geochemical avobutton of the earth. We begin to understand the general alructure and internel convective motions that control the earth's surace, our environment, and our resources.

• 20% diacount to AGU membais Orders undar \$50 musi ba prepaid



\_V/SA

### John F. Dewey—Tectonics Editor

'I want the journal to acquire a reputation for very rapid fair, and accurate reviewing, asserted John F. Dewey, editor-in-chief of AGU's newest journal, Tectonics. Dewey said that he will rule the bimonthly, which will begin publication In February, 'with e bit of a rod of Iron' to ensure that Tectonics is 'where only original end important papers ere pub-

'I'm going to be very strict with reviewers.' Dewey explained in his quick British clip, 'If the review does not come beck to me within 10 days to 2 weeks, I'll review the paper myself. I'm elso going to have e system whereby, if e paper needs major surgery elter being relereed, it will be rejected. Pepers will heve to be in virtually publishable condition before they are liret submitted, he seld.

A repid reviewing process end a demand for high-quality papers will distinguish Tectonics from other journals that touch on the field. Dewey eald. The new journal also will carve out its niche by being heavily weighted towerd the geological espects of plete tectonics. There's no other journal thei emphesizes that aspect, he noted. He elso pointed out that Tectonics will not detract from the red section of the Journal of Geophysical Research. While JGR-Red concentrates on the geophysics of tectonics and marine plates. Dewey wants to emphasize continental tectonics.

Concerned with high standerds. Dewey talks about the birth end growth of Tectonics: "I'll be very happy onco the journal hes, say, two years of line tssues under its belt. It takos six months or a year or even two years to eccelerate

to got a tino journel going.

Fobruary's issue will include six or seven papera, but Dewey said he aims for high quality, not quantity, of papere. 't don't care it we only publish four or live popers an issue, provided those papers are truly first rate."

Aiding Dowey will be Paul Tapponnier as European editor and B. Clark Burchfiel es North American editor. A board of essociate editors will essisi them.

Dewey, e native of London, received Ph.D. and D.I.C. degrees in 1960 from Imperial College, University of London. He lectured on structural geology at the universities of Manchester end Ceinbridgo from 1960 to 1970, and then he joined the State University of New York at Albany.

The Sixth International Symposium on the Physics and

sium, to be convened for the lirst lime in the United Stetes,

will cover lundamental studies of Ice phases, experimental

and theoretical work, and investigations that depend in part

on the properties of ice (including meteorology, atmospher-

ic electricity, glaciology, planetary modeling, engineering

problems caused by clathrate ices, and the biological el-

cal properties, ice evolution, extraterrestrial ice, surface

Other toolcs to be covered include diffusion end retax-

ation phenomena, lettice dynamics, electrical and machani-

structure end properties, ice chemistry, end geological avo-

Abstracts must be written in English and include euthors'

The progrem for this yeer's aarospace meeting of The In-

ing Global Positioning System (GPS) of nevigetion setel-

liles, inertiel navigation systems, and other electronic nevi-

gation systems end their applications. Also included in the

program were a limited number of papers eddressing tha

The Global Positioning System is a constallation of 18

navigation satellites being developed by the Department of

The system will support a multitude of militery spolications.

The tirsi paper by Jecobson reviewed the engineering de-

velopment of GPS navigation receivers stressing the use of

common hardware end eoltware modulos. A later paper by

Ould described the mechanization of a digital receiver for

sprood spectrum satellite transmissions than analog receiv-

ers. The paper by Brady discussad the worldwide coverege

that is provided by the limited number of setellites that will

constitute the GPS constellation through 1983. The capabil-

ity provided by the setellitas presently on orbit would sup-

of multiple setellito evatlebility ere provided for numerous

worldwide locations. For civil aviation applications, Vocal

cost GPS user equipment, Esposito described the Federal

Avietion Administration acceptance tests of a GPS navige-

tion receiver, and Hopkins discussed the design and cape-

bility of en integrated GPS strapdown attitude and heeding

eddressed the eatellite geometry considerations for low

port a veriety of experiments at almost any location. Tables

GPS applications designed for faster acquisition of the

Delense to provide instantaneous worldwide navigetion.

National Aerospace Meeting of The Institute of

Chemistry of ice will be held on the Rolla Campus of the

University of Missouri on August 2-6, 1982. The sympo-

Meetings

Physics and Chemistry of Ice

fects of ice formation).

Navigation

by Patrick Fell

lution es reveeled by tce samples.

geodetic use of the GPS system.

reference system for avionics.



John F. Dewey

In 1967 he came to North America on sebbsticel ee e visiting research essociate et the Lamont-Doherty Geological Observatory. 'It was just tuck that I happened to be on sabbatical et the right place at the right time, Dewey seld. It was then that some of the scientists-such as Xevier Le Pichon, Walter Pitmen, and Lynn Sykes—vitel to the development of plate tectonics were at Lemont working on the theory. I learned e massive amount from these people, including a whole new methodology for the science of geology. In e period of about three months,' Dewey rellected, 'my eilltude towerds geology was trensformed,' to viewing it In terme of plate tectonics.

in 1980 he wee promoted to distinguished professor et Albany. This Christmes he will step down from that post to become profeesor of geology at the University of Durham in England end research professor et Albeny. He will continue to pursue his current research, which includes study of the neotectonic evolution of Anatolia; the structural history of the Err. Ele, end Stivrette nappes in aastern Switzerlend: stretigrephic and thermel evolution of ritt basins and hydrocerbon maturetion; and the lectonics of overthrust beits and the evolution of foreland basine. Dewey also plans to write s graduate textbook on the principles of piste tactonics.

What I would like to look back on in 20 years when I retire," Dewey seld, "is to see a row of Tectonics issues that essentietly would form e handbook that would be the first pieca peopla would look for the critical date on and synthesas of the regional tectonics of the world, -BTR

names, paper litls, and s two- or three-sentence summa-

ry, deadline is January 15. Extended ebatrects and regle-

tration forme ere due May 1. Registration (see ere \$75 for

professionals and \$25 for students. A \$25 lete tee will be

the technical progrem should be eddressed to the conference chairman, Petricia L. M. Piummer, Greduate Center

for Cloud Physics Research, 109 Norwood Hall, University of Missouri, Rolla, MO 65401 (telephone: 314-341-4340).

information about the social program, registration, and housing can be obtained by writing to the coordinator, Mer-

The conference is sponsored by the American Physical

Society, the American Chamical Society, the American Me-

teorological Society, and the Internetional Commission on

Snow end Ice of the International Union of Gaologists and

Geodetic epplications of the GPS system to mepping,

fense Mapping Agency. These include the first GPS receiv-

er for spece application aboard a luture NASA LANDSAT

mission and the testing and development of geodetic re-

ceivers for terrestriel surveying operations. This latter pro-

NOAA/NGS. The paper presented by Evens described the

accurecy obtainable for selimating changes in geodetic re-

A eecond major erea of discussion was inertial navigation systems end related lopica. A paper by Giardine pre-

eents a comparative study of elgorithms used in strapdown

navigation systems. Hung discussed the effect of accelera-

navigation systems ere not located at the center of rotation.

Bachman presented flight test reculle for the ring leaer gyro

nevigator, and DiPasquo discussed the dealgn delinition for

an advanced elecreft inertial sensor system. Other pepers

dealing with hybrid strapdown systems, nevigetion eystems

planning, memory requiremente for eerospace nevigation

Another collection of papers deelt with other electronic

navigetion systems. One euch system, the Joint Tscilcaf information Diatribution System (JTIDS), is e defense com-

municatione system providing the means for obtaining ac-

curate range measurements to support relative navigation.

Papers by Welss and Rome described navigetional aspects

of this system. A paper by Gupte discussed Omege algnal

selection, and Rome discussed error end decision enalyale for the BCAS electait collision evoldance system. Gerze-

Roblea presented a paper on en autonomous Doppler post-

systems, and aircrett velocity sanaing were presented.

tion errors caused by vehicle rotations when strapdown

ceiver antenna positiona using GPS Doppter techniques.

gram is jointly sponsored by DMA, NASA, USGS, end

chaning, end geodesy were summarized by Senus, who

described two programs under davelopment by the De-

tha Fort, 105AH/SS, University of Missouri, Rolle, MO

cherged for registretion received after May 1. Quastions on

AGU CHAPMAN CONFERENCE

Scholarship Assistance

for Minority Students in Earth.

Space, and Marine Science

For 1982-1983

The American Geophysical Union is once again pleased to

participate in the American Geological Institute's Minority

Graduate or undergraduate students with good

study earth, space, or marine science

For a flyer for your student, call or write to:

· Enrolled in, or applying to, an accredited institution to

Member Programs . American Geophysical Union . 2000

Florida Ave., N.W. • Washington, D.C. • 20019 462-6903 or 800-424-2458 outside the Washington, D.C. area

William H. Mathews III, Director of Education . American

Application Deadline, February 1, 1982

Geological Institute . Box 10031, Lamar University Station .

Black, American Indian, or Hispanic students who are

Scholarship Assistance Program

Eligible Condidates are:

academic records

For applications, write to:

Beaumoni, Texas. . 77710

RAINFALL RATES April 27-29, 1982 Urbona, Illinois

Convenor: D. M. Hershfield

Sessions plenned:

Atmospheric physics as related to rainfall process-

Meesurement: mess (lipping burket), photoelectric, magnetic, and remote methods.

Models: physical, methernnilcul, and statistical. Applications: point, eres, quasihorizontal path, sur face, troposphere, and stratosphere.

Call for papers published in EOS, July 14. Abstract deedline: Decembar 21, 1981.

### tectonics

John F. Dewey, editor-in-chief Paul Tapponnier, european editor B. Clark Burchfiel, north american editor

> tectonics will keep you abreest of: Recent edvances in experimental

- iechniquest The development of new theories?
- Successful solutions to problems In crustel evolution through

AGU EGS \$20 Students \$10

current global lectonicsi

Volume 1 February 1982 blmonthly thereafter

## ORDER NOW

American Geophysical Union 2000 Floride Ave., N.W. Weshington, D.C. 20009 462-6903

800-424-2488 outside the Weshington, D.C. erea

tioning system using the NIMBUS-6 satellite, which localed moored or (rea-floating buoys end westher balloons from a aingle setellite pess.

The meeting was informetive (or the perticipants, primer ly addressing nevigation, but offered some useful injuries tion to some in the AGU community. A volume of the proceedings is available from The Institute of Nevigsion, Suffer 832, 815 15th Street, N.W., Weshington, D. C. 20005.

This meeting report was prepered and submitted by Patrick Fell of the Space and Ocean Geodesy Branch, Space and Surface Systems Division, Naval Surface Wedpons

### Ocean Sciences: AGU/ASLO Joint Meeting



A joint meeting of the American Geo-physical Union's Oceanography Section and the American Society of Limnology end Oceanography will be held Febru-ery 16-19, 1982, in Sen Antonio, Texes

Registration. Everyone who altends the meeting must register. Preregistretion (received by January 29) seves you time end money, and the lee will be refunded it AGU receives written notice of inebility to ettend by Febru-

Registration rates are as followe:

	Preregistretion	At Meeting (efter 1/29)
Membel	\$55	\$70
Student Member	\$25	\$40
Nonmember	\$75	\$90
Sludent nonmember	\$32	\$47
	day anh la avail	able at half the about

Registration for 1 day only is svalleble at half the ebove rates. Members of American Geophysical Union, American Society of Limnology end Oceanography, Marine Technoloov Society, end American Meteorological Society may register at the mamber rates.

The difference between member (or student member) registration and nonmember registration may be applied to AGD dues if e completed membership application is received at AGU by Mey 19, 1982. Curreni AGU ennuel membership rates are: \$20 members; \$7 etudent members.

To preregister, lilf out the registration form, and return it with your payment to the AGU Office. Your receipt will be included with your preregistration material at the meeting. Preregistrants should pick up their registration material et the preregistration desk at the Et Tropicano Hotel, headquarters for the meeting. Complimentary badges for guesis not attending the scientific sessions will be available of the registration deak,

Hotel Accommodations. Blocks of rooms are being held at the El Tropicano, the St. Anthony, and the Gun ter totels. Read the housing application end MAIL THE COMPLETED APPLICATION FORM TO THE HOUSING DEPARTMENT, Sen Antonio Convention end Visitors Bumeu, P.O. Box 2277, Sen Antonio, Texas, 78298, MAIL EARLY to insure confirmation et your preferred hotel. DEADLINE FOR RESERVATIONS IS JANUARY 15, 1982. Please do not write or call the AGU office for room reserva-

Sociel Events. Complimentery refreshments will be served daily from 9:30 to 10:30 A.M., from 2:30 to 3:30 P.M., and again at the ice Breekar Immediately following he session on Tuesday evening.

Aluncheon is plenned for Wednesday in the Southwest Craft Center, one of the Southwest's finest examples of French srchilacture of the late 1800's. Fred Splinaus, Exective Director of AGU will speak on Society Collaboration-Strength for Ocean Sciences. Reserve early as space is limited. Cosl-\$8.75 per ticket.

All of the aeaslons will be held in the El Tropicano Hotel.

Thursday

Anthropegenic inputs (AM)

#### Program Summary

Particle Fluxee t (AM)

Groulation (PM)

Processee (PM)

Small-Lake Limnology (PM)

Feeding Dynamics (AM) Particle Fluxes Iti (AM) Ocean-River Interaction (AM) Coastal Processee I (AM) Large-Lake Proceesee (AM) Citmete end Productivity (AM) Anthropegenic inputs (PM) Periode Fluxes It (PM) Gult of Mexico Biology end Circulation (PM) Ocean-River Interection (PM) Large-Leke Proceeees (PM) Cosetel Processes It (PM) Pings (PM) Microecale Processes (PM) Marine Optice (PM) Wedneedey Program (AM)

Fridey Microblel Dynamics (AM) Biogeochemical Cycling (AM) PROBES (AM) SANDS (AM) Measurement Techniquee (AM) Small-Lake Limnology (AM) Coastal Processes III (AM) Bioturbation (AM) large Oceanographic Programs (PM) Microbiet Dynemice (PM) Mogeochemical Cycling (PM) General. Oceenography (PM)

Measurement Techniques (PM)

Trace Matale IPM)

Bloturbation (PM)

The program and meeting abetracts will . method to all members of AGU/ASLO in advance of the meeting.

address during the meeting it different than above

**DOWN TOWN**  Et Tropicano Hotel SAN ANTONIO St. Anthony Holei Southwest Craft **( 0 0** CROCKLIT.

### Ocean Sciences: AGU/ASLO Joint Meeting

February 16-19, 1982 San Antonio, Texas

IMPORTANT INSTRUCTIONS

P.O. Box 2277

San Antonio, Texas 78298

\_\_\_\_ Multiple(s) |4 persons|

\_\_\_\_ Suite (1 bedroom; parlor)

RETURN THIS FORM WITH

PAYMENT TO:

Meetings Registration American Geophysical Union

2000 Floride Ave., N.W.

Weehington, D.C. 20009

PLEASE PRINT CLEARLY

NAME ON BACOE -

AFFILIATION

MAILING ADDRESS

Qunter Hotel

300 East Travle

300 Augusta

The San Antonio Convention and Visitors Bureau will make hotel assignments upon receipt of the official housing application, provided that it is properly filled out and all necessary information is given. All rooms will be assigned on a first come, lirst serve basis. All requests must be on this form. Telephone requests are not accepted, OFFICIAL HO TEL CONFIRMATION WILL ADVISE DEPOSIT POLICY, DO NOT SEND MONEY WITH THIS FORM.

Ocean Science Meeting American Geophysical Union Cutoff date for reservations is Housing Department San Anionio Convention and Visitors Bureau January 15, 1982

AGILIASILO 🕲

HOTEL-MOTEL PREFERENCE: Indicate by number (1) (2) (3): Fadure to list maximum number of choices will result in delay as form will be returned for additional selections Gintor Hotel \_\_\_\_ \_ Arned date \_\_\_\_\_\_ El Tropicano Hotel Single \$37 Double \$47 Double 5d1 Double hum still A lo a room \$51 Double double \$80 3 to a 100m \$55 dipon room: Sut King \$78 4 to a room \$63 Departure date 3 to a room \$80 List below the names of persons occupying each room TYPE OF ACCOMMODATIONS DESIRED (INDICATE THOSE SHARING ACCOMMODATIONS) TYPE OF ROOM . Single(s) (1 person, 1 bed) \_\_\_\_ Double|s| |2 persons, t bed) \_\_\_\_ Twins|s| (2 persons, 2 beds) \_\_\_\_ Multiple|s| 13 persons|

\_\_\_\_\_ Suite t2 bedrooms; parlor MAIL CONFIRMATION TO: IPlease list only one person to receive acknowledgement. If this request is being sent in for a group of people, be sure others do not duplicate. OR I TYPE) Telephone No.: A.C.

Ocean Sciences:

AGU// Joint M	eeting	PREREGISTRATION January 29, 1982 (rates applicable only if received by Jenuary 28 with pay		
February 18 19, 1982 San Antonio, Texas			More than one day	One day
REGISTRATION FORM  Days you plan to ettend  Tuesday  LI Wednesday		MEMBER	f3 \$55	13 52
		STUDENT MEMBER	C3 \$25	L) \$1)
		нонменаея	CJ <b>875</b>	<b>د.</b>
☐ Thuisdsy	[] Fridey	STUDENT NONMEMBER	C3 \$32	C1 <b>\$1</b>
Please check appropriate boy Members of appropriate societies may regis-		ABSTRACTS (January, 19.	1982, EOS)	*
		TONCHEON MEGNESON		5

1 Member ASLO .	
1 Member sponsoring society.	Charge to   V-52
AMS-American Meteorological Society	1 1 144101
MTS-Marine Technology Society	
☐ Normember	Card Number
Honmembers	Expension Date
The difference between member [or Muden]	Cthront, nav.
member registration and nonmember registration may be applied to AGU dues if it	Sgnature
combleted memperatrib statement is	Squarory
received at AGU by May 19, 1962. Current	
received at AGU DY MAY 19, 1902. Cultura	

received at AGL AGU annual membership is Members; 57 Student Memb Your receipt will be in your preregistration packet. The registration has will be refunded in written notice of inability to sitend is received in

the AGLI office by February S.

Office Use Reference Number

Other payments |Plsase Identity) \$\_ Total enclosed \$\_ (All orders must be accompanied by psyman) or cradil card information. Make check payable to AOU)

DEADLINE FOR RECEIPT OF

Office Use

1.3